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Uranium	19.1	—	High Temperature Steels	7.88	7.77
Tantalum	16.6	—	Carbon Steels	7.83	—
Tungsten Carbide Cermet	15.2	13	Free-Cutting Steels	7.83	—
Hafnium	13	—	Low Alloy Steels (cast)	7.83	—
Tungsten-Titanium Carbide Cermet	13	10.5	Nitriding Steels	7.83	—
Rhodium	12.4	—	Ultra High Strength Steels	7.83	7.63
Ruthenium	12.2	—	Tin-Base Babbitts	7.76	7.34
Palladium	12	—	Ferritic Stainless Steels	7.75	7.47
Thorium	11.6	—	Low Alloy Steels	7.75	—
Lead & Its Alloys	11.3	10.7	Martensitic Stainless Steels	7.75	—
Lead-Base Babbitts	10.62	9.30	Wrought Irons	7.69	—
Silver	10.5	—	Austenitic Nodular Irons	7.43	—
Molybdenum	10.2	—	Aluminum Bronzes (cast)	7.33	7.55
Yellow Brasses (cast)	9.96	7.70	Tin & Its Alloys	7.30	7.25
Tin Bronzes (cast), High Leaded	9.49	8.85	Malleable Irons	7.29	7.13
Cobalt-Base Superalloys	9.13	8.30	Nodular Irons	7.21	7.17
Copper	8.95	8.89	Titanium Carbide Cermet	7.2	5.5
Cupro-Nickels	8.94	—	Gray Irons	7.19	—
Nickel Brasses & Bronzes (cast), Leaded	8.92	8.82	Zinc & Its Alloys	7.17	6.64
Silicon Bronzes	8.91	7.09	Heat Resistant Nodular Irons	6.9	—
Red & Semi-Red Brasses (cast), Leaded	8.90	8.56	Zirconium & Its Alloys	6.64	6.56
Chromium Copper	8.88	—	Vanadium	6.36	—
Phosphor Brasses	8.88	8.74	Alumina Cermets	6.09	5.81
Cobalt	8.86	—	Molybdenum Disilicide	6	5.9
Gilding, 95%	8.86	—	Titanium & Its Alloys	4.73	4.43
Tin Bronzes (cast), Leaded	8.85	8.60	Lead Silicate Glasses	4.3	3
Monel	8.84	8.48	Zircon	3.9	3.4
Leaded Commercial Bronze	8.83	—	Alumina Ceramics	3.85	3.45
Leaded Brasses	8.82	8.41	Micas	3.8	2.6
Commercial Bronze, 90%	8.8	—	Epoxies (cast), Ht Res	3.2	1.15
Nickel Silvers	8.74	8.66	Silicon Carbide	3.1	2.6
Red Brass, 85%	8.74	—	Silicon Nitride	3.1	—
Low Brass, 80%	8.66	—	Aluminum & Its Alloys (cast)	2.96	2.57
Cr-Ni-Co-Fe Superalloys	8.60	8.19	Forsterite	2.9	—
Columbium	8.58	—	Steatite	2.9	2.5
Tin & Aluminum Brasses	8.53	8.33	Aluminum & Its Alloys	2.82	2.62
Admiralty Brass	8.52	—	Aluminum Silicate Fibers	2.7	—
Cartridge Brass, 70%	8.52	—	Cordierite	2.7	2.3
Yellow Brass	8.47	—	Asbestos Fibers	2.6	2.4
Duranickel & Inconel	8.44	8.08	Polycrystalline Glass	2.6	2.5
Leaded Naval Brass	8.44	—	Glass Fibers	2.54	—
Naval Brass	8.41	—	Aluminum Silicate Glass	2.5	—
Nickel-Base Superalloys	8.4	7.9	Boron Carbide	2.5	1.9
Muntz Metal	8.38	—	Soda-Lime Glasses	2.5	—
Manganese Bronze (A)	8.36	—	Standard Electrical Ceramics	2.5	2.4
Aluminum Brass	8.33	—	Epoxies (cast), GP	2.4	1.12
Beryllium Copper	8.24	8.18	Borosilicate Glasses	2.3	2.1
Low Expansion Nickel Alloys	8.19	8.08	Fluorocarbon Fiber	2.3	—
Cr-Ni-Fe Superalloys	8.17	7.88	TFE Fluorocarbons	2.3	2.1
			Alkyds, GP	2.24	2.22

* Values represent high and low sides of a range of typical values.

Specific Gravity*

Comparisons
of Materials

Material ↓	High	Low	Material ↓	High	Low
Plastics Laminates, Low Pressure	2.2	1.2	Epoxies (cast), Resilient	1.25	—
Silica Glasses	2.2	—	Neoprene Rubber	1.25	—
Alkyds, Electrical	2.15	2.05	Silicone Rubber	1.25	—
CFE Fluorocarbons	2.15	2.10	Urethane Rubber	1.25	—
TFE Film	2.15	—	Cellulose Propionate	1.24	1.18
CFE Film	2.11	—	Phenolics (molded)	1.24	3
Boron Nitride	2.1	—	Polycarbonate	1.20	—
Alkyds, Impact	2.08	2	Polyvinyl Butyral	1.20	1.07
Melamines	2	1.43	Acrylics, GP	1.19	1.17
Silicones (molded)	2	1.6	Acrylics, High Impact	1.16	1.12
Hard Rubber	1.95	1.15	Ethyl Cellulose	1.16	1.10
Graphite	1.9	1.4	Ethyl Cellulose Film	1.16	1.14
Beryllium	1.85	—	Rubber Hydrochloride Film	1.15	1.12
Epoxies (molded)	1.85	—	Nylons 6, 11, 66 & 610	1.14	1.09
Plastics Laminates, High Pressure	1.78	1.15	Nylon 6 Film	1.12	—
Magnesium Alloys	1.76	1.68	Modified Polystyrenes	1.11	1.04
Vinylidene Chloride	1.75	1.68	Nylon Fiber	1.1	—
Diallyl Phthalate, Asbestos-Filled	1.70	1.65	Imported Woods	1.09	0.14
Vinyl Fibers	1.7	1.3	Polystyrene Film	1.07	1.05
Polyvinylidene Chloride Film	1.68	—	Polystyrenes, GP	1.07	1.04
Bast Fibers	1.6	1.5	ABS Resins	1.06	1.01
Carbon	1.6	1.5	Methylstyrenes	1.06	1.01
Cotton Fiber	1.6	—	Nitrile Rubber	1	—
Diallyl Phthalate, Glass Fiber-Filled	1.59	1.55	Polyethylene Fibers	0.96	0.92
Cellophane	1.55	1.40	Polyethylenes, High Density	0.96	0.94
Polyvinyl Chloride	1.55	1.16	Polyethylene Film	0.945	0.92
Ureas	1.52	1.47	Polyethylenes, Medium Density	0.94	0.93
Nylon, Glass-Filled	1.51	1.30	Styrene-Butadiene Rubber	0.94	—
Cellulosic Fibers	1.5	1.3	Natural Rubber	0.93	—
Fluorinated Acrylic Rubber	1.5	—	Polyethylenes, Low Density	0.925	0.910
Polyvinyl Chloride Film	1.50	1.15	Polypropylene	0.91	0.90
Allyls (cast)	1.46	1.20	Polypropylene Fiber	0.91	0.9
Cellulosic Films	1.46	1.16	Butyl Rubber	0.90	—
Polyesters (cast)	1.46	1.06	Polypropylene Film	0.90	—
Acetal	1.43	—	Wood Comp Board, Softboard	0.8	0.2
Acrylic Fibers	1.4	1.1	American Hardwoods	0.7	0.4
Animal Fibers	1.4	1.3	Wool Felts, Sheet	0.7	0.3
Cellulose Nitrate	1.40	1.35	American Softwoods	0.5	0.4
Chlorinated Polyether	1.4	—	Neoprene Foams	0.48	0.16
Diallyl Phthalate, Dacron Filled	1.4	—	Polyethylene Foam, Flexible	0.47	—
Polyester Fibers	1.4	—	Butadiene-Acrylonitrile Foam	0.4	0.16
Polyvinyl Formal	1.4	1.2	Urethane Foamed-in-Place, Rigid	0.4	0.008
Wood Comp Board, Hardboard	1.4	0.08	Wool Felts, Roll	0.4	0.2
Polyester Film	1.39	—	Prefoamed Epoxy, Rigid	0.32	0.08
Polysulphide Rubber	1.35	—	Urethane Foams, Flexible	0.32	0.016
PVC-Nitrile Rubber Blend Film	1.35	1.18	Silicone Foams, Rigid	0.26	0.19
Cellulose Acetate	1.34	1.23	Phenolic Foamed-in-Place, Rigid	0.16	0.03
Diallyl Phthalate, Orlon Filled	1.34	1.31	Polystyrene Foamed-in-Place, Rigid	0.16	0.032
Phenolics (cast)	1.33	1.31	Prefoamed Cellulose Acetate, Rigid	0.13	0.06
Polystyrenes, Glass-Filled	1.32	1.25	Natural Rubber Foam	0.112	0.096
Polyvinyl Alcohol	1.31	1.21	Butadiene-Styrene Foams	0.07	—
Polyvinyl Alcohol Film	1.31	1.21	Prefoamed Polystyrene, Rigid	0.07	0.02
Wood Comp Board, Particle	1.28	0.42	Vinyl Foams, Flexible	>0.064	—
Cellulose Acetate Butyrate	1.25	1.15			

* Values represent high and low sides of a range of typical values.

Comparisons of Materials

Thermal Conductivity*

Btu/hr/sq ft/°F/ft

Material ↓	High	Low	Material ↓	High	Low
Silver ^b	242	—	Austenitic Stainless Steels ^b	9.4	8
Copper	226	196	Columbium Carbide	8.2	—
Chromium Copper	187	—	Carbon ^b	5	3
Gold ^b	172	—	Calcia ^d	4.1	—
Aluminum & Its Alloys	135	67.4	Zircon	3.6	2.9
Plain Brasses	135	67	Cordierite & Forsterite	2.4	0.9
Graphite ^b	120	70	Polycrystalline Glass	2.1	1.1
Phosphor Bronzes	120	29	Steatite	1.94	1.45
Beryllium Copper	110	100	Electrical Ceramics	1.6	0.9
Leaded Brasses	104	67	Magnesia ^d	1.5	—
Tungsten ^b	96.6	—	Wood Comp Board	1.5	0.08
Aluminum & Its Alloys (cast)	92.5	51.0	Wool Felts (1 in.), Sheet	0.91	0.30
Beryllium ^b	87	—	Silicon Nitride ^d	0.9	—
Molybdenum ^b	84.5	—	Epoxies (cast)	0.8	0.1
Magnesium Alloys	80	24	Silica Glasses ^b	0.8	—
Tin & Aluminum Brasses	67	58	Silica, Vitreous ^d	0.8	—
Zinc & Its Alloys	65.3	60.5	Borosilicate Glasses ^b	0.7	—
Tungsten Carbide Cermet	50.1	25.7	Alkyds	0.60	0.20
Rhodium ^b	50	—	Wood Comp Board, Softboard	0.6	0.3
Platinum ^b	42	—	Lead Silicate & Soda-Lime Glasses ^b	0.5	—
Palladium ^b	41	—	Zirconia ^d	0.5	—
Low Alloy Steels ^b	38.5	21.7	Polyvinyl Alcohol	0.46	—
Tin & Its Alloys	37	34	Melamines	0.41	0.17
Nickel & Its Alloys ^b	36	8.7	Micas	0.4	0.2
Wrought Irons ^b	34.5	—	Phenolics (molded)	0.39	0.10
Gray Irons (cast) ^b	34	24	Wool Felts (1 in.), Roll	0.39	0.24
Iridium ^b	34	—	Plastics Laminates, High Pressure	0.29	0.17
Aluminum Bronzes (cast)	33	22	Ureas	0.24	0.17
Tungsten-Titanium Carbide Cermet	32.9	16.5	Cellulose Acetate & Propionate	0.19	0.10
Columbium & Tantalum ^b	31.5	—	Polyethylenes	0.19	—
Silicon Bronzes	31	20	Ethyl Cellulose	0.17	0.09
Nitriding Steels ^b	30	—	Acrylics	0.15	0.10
Malleable Irons	29.5	—	CFE Fluorocarbons	0.145	—
Alumina Cermets ^a	29	—	Nylons 6, 11, 66 & 610	0.14	0.10
Silicon Carbide ^a	29	9	Styrene-Butadiene & Nitrile Rubber	0.14	—
Tin Bronzes (cast), Leaded	28	—	TFE Fluorocarbons	0.14	—
Carbon & Free-Cutting Steels ^b	27	—	Acetal	0.13	—
Low Alloy Steels (cast) ^b	27	—	Cellulose Nitrate	0.13	—
Tin Bronzes (cast), High Leaded	27	—	ABS Resins	0.12	0.08
Cupro-Nickels & Nickel Silvers	26	17	Nylon, Glass-Filled	0.12	—
Thorium	21.4	—	Polyesters (cast)	0.12	0.10
Martensitic Stainless Steels ^b	21.2	11.7	Silicone Rubber	0.12	0.11
Nodular or Ductile Irons ^b	20	18	Neoprene Rubber	0.11	—
Lead & Its Alloys ^b	19.6	16.0	Polycarbonate	0.11	—
Cobalt-Base Superalloys ^a	18.0	11.9	Polyvinyl Chloride	0.10	0.07
High Temperature Steels ^a	17.3	15.8	Silicones (molded)	0.097	0.089
Boron Nitride ^a	16.6	—	Polyvinyl Formal	0.09	—
Ultra High Strength Steels ^a	16.6	—	Natural Rubber	0.08	—
Boron Carbide ^d	16	—	Polypropylene	0.08	—
Heat Resistant Alloys (cast) ^b	51.2	7.7	Polystyrenes, GP	0.08	0.06
Ferritic Stainless Steels ^b	15.1	12.1	Modified Polystyrenes	0.07	0.02
Cr-Ni-Fe Superalloys ^a	15	12.2	Butyl Rubber	0.05	—
Nickel-Base Superalloys ^a	15	9.5	Vinylidene Chloride	0.05	—
Stainless Steels (cast) ^b	14.5	8.2	Urethane Foamed-in-Place, Rigid	0.03	0.01
Uranium	14.5	—	Neoprene Foams	0.029	0.021
Tin-Lead-Antimony Alloys ^b	14	—	Prefoamed Cellulose Acetate, Rigid	0.027	0.025
Tantalum Carbide	12.8	—	Butadiene-Acrylonitrile Foams	0.025	0.021
Age Hardenable Stainless Steels ^b	12.1	8.87	Natural Rubber Foam	0.025	0.021
Zirconium Carbide	11.9	—	Silicone Foams, Rigid	0.025	—
Alumina Ceramics ^b	10.7	6.2	Phenolic Foamed-in-Place, Rigid	0.02	—
Low Expansion Nickel Alloys ^b	10.3	7.8	Polystyrene Foamed-in-Place, Rigid	0.02	—
Titanium Carbide	9.9	—	Prefoamed Epoxy, Rigid	0.02	—
Titanium & Its Alloys ^b	9.8	4.3	Prefoamed Polystyrene, Rigid	0.02	—
Zirconium & Its Alloys ^b	9.6	8.1	Butadiene-Styrene Foams	0.018	—
Beryllia ^d	9.52	—	Thoria ^d	0	—

* Values represent high and low sides of a range of typical values at room temperature except where noted.

^b At temperatures between 120 and 212 F.

^a At temperatures between 212 and 1800 F.

^d At temperatures above 1800 F.

Coefficient of Thermal Expansion*

10⁻⁶ in./in./°F

Material ↓	High	Low	Material ↓	High	Low
Silicone Rubber.....	670	—	Cupro-Nickels & Nickel Silvers ^a	9.3	9
Nitrile Rubber.....	390	—	Nickel & Its Alloys ^d	9.2	6.8
Natural Styrene-Butadiene Rubber.....	370	—	Cr-Ni-Co-Fe Superalloys ^d	9.1	8
Neoprene Rubber.....	340	—	Low Alloy Steels ^d	8.6	6.3
Butyl Rubber.....	320	—	Carbon Free-Cutting Steels ^d	8.4	8.1
Polyethylenes, Medium & High Density.....	167	83	Low Alloy Steels (cast) ^d	8.3	8
Polyvinyl Butyral.....	127	44	Age Hardenable Stainless Steels ^a	8.2	5.5
Ethyl Cellulose.....	110	55	Gold ^a	7.9	—
Polyethylenes, Low Density.....	110	89	High Temperature Steels ^d	7.9	6.3
Silicon Bronzes ^a	100	98	Magnesia ^a	7.8	—
Cellulose Acetate & Propionate.....	90	44	Ultra High Strength Steels ^d	7.61	5.68
Vinylidene Chloride.....	87.8	—	Calcia ^a	7.6	—
Nylons 6 & 11.....	71	46	Malleable Irons ^a	7.5	5.9
Polyvinyl Alcohol.....	66.5	38.8	Titanium Carbide Cermet ^d	7.5	4.3
Cellulose Nitrate.....	66	44	Wrought Irons ^a	7.4	—
Phenolics (cast).....	66	33	Titanium & Its Alloys ^d	7.1	4.9
Polypropylene.....	62	—	Cobalt ^d	6.8	—
ABS Resins and Modified Polystyrenes.....	56	22	Martensitic Stainless Steels ^a	6.5	5.5
Polyesters (cast).....	56	28	Nitriding Steels ^d	6.5	—
Nylons 66 & 610.....	55	—	Palladium ^a	6.5	—
TFE Fluorocarbons.....	55	—	Beryllium ^b	6.4	—
Acrylics and Epoxies (cast).....	50	30	Chromium Carbide Cermet ^a	6.3	5.8
Urethane Foams.....	50	14	Thorium ^b	6.2	—
Acetal and Chlorinated Polyether.....	45	44	Ferritic Stainless Steels ^a	6	5.8
Polystyrenes, GP.....	44	33	Gray Irons (cast) ^a	6	—
Polyvinyl Formal.....	42.7	35.5	Beryllium Carbide ^d	5.8	—
Polycarbonate.....	39	—	Low Expansion Nickel Alloys ^a	5.5	1.5
CFC Fluorocarbons.....	38.8	—	Beryllia & Thoria ^a	5.3	—
Diallyl Phthalate.....	35	15	Alumina Cermets ^d	5.2	4.7
Silicones (molded).....	32.2	4.5	Lead Silicate Soda-Lime Glasses ^a	5.1	4.8
Melamines and Alkyds.....	31.7	8.2	Molybdenum Disilicide ^a	5.1	—
Micas, Natural & Synthetic ^b	27	18	Ruthenium ^b	5.1	—
Phenolics (molded).....	25	8.3	Platinum ^a	4.9	—
Prefoamed Cellulose Acetate, Rigid.....	25	20	Vanadium ^b	4.8	—
Prefoamed Polystyrene, Rigid.....	25	—	Forsterite ^a	4.7	—
Polystyrenes, Glass-Filled.....	24	22	Rhodium ^b	4.6	—
Prefoamed Epoxy, Rigid.....	22	16	Tantalum Carbide ^d	4.6	—
Mica, Glass-Bonded ^b	20	5.8	Boron Nitride ^d	4.3	—
Zinc & Its Alloys ^a	19.3	10.8	Titanium Carbide ^d	4.1	—
Nylon, Glass-Filled.....	17	12.5	Polycrystalline Glass ^a	4	0.2
Plastics Laminates, High Pressure.....	17	5.5	Steatite ^a	4	3.3
Lead & Its Alloys ^a	16.3	14.4	Tungsten Carbide Cermet ^a	3.9	2.5
Magnesium Alloys ^b	16	14	Columbium ^d	3.82	—
Ureas.....	15	12	Iridium ^b	3.8	—
Tin-Lead-Antimony Alloys ^a	14.6	10.9	Alumina Ceramics ^a	3.7	3.1
Epoxies (molded).....	14	—	Zirconium Carbide ^d	3.7	—
Plastics Laminates, Low Pressure.....	14	10	Osmium and Tantalum ^b	3.6	—
Aluminum & Its Alloys ^a	13.7	11.7	Zirconium & Its Alloys ^b	3.6	3.1
Tin & Its Alloys ^a	13	—	Hafnium ^b	3.4	—
Uranium ^a	12.1	—	Polyvinyl Chloride.....	3.3	2.8
Tin & Aluminum Brasses ^a	11.8	10.3	Zirconia ^a	3.1	—
Plain & Leaded Brasses ^a	11.6	10	Molybdenum ^b	3	—
Silver ^a	10.9	—	Borosilicate Glasses ^a	2.5	1.8
Cr-Ni-Fe Superalloys ^d	10.5	9.2	Aluminum Silicate Glass ^a	2.3	—
Heat Resistant Alloys (cast) ^d	10.5	6.4	Silicon Carbide ^a	2.2	2.4
Nodular or Ductile Irons (cast) ^a	10.4	6.6	Tungsten ^b	2.2	—
Stainless Steels (cast) ^d	10.4	6.4	Cordierite ^a	2.1	—
Tin Bronzes (cast) ^a	10.3	10	Electrical Ceramics ^a	2	—
Austenitic Stainless Steels ^a	10.2	9	Zircon ^a	1.8	1.3
Phosphor Bronzes ^a	10.2	9.6	Boron Carbide ^a	1.7	—
Coppers ^a	9.8	—	Carbon and Graphite ^a	1.5	1.3
Nickel-Base Superalloys ^d	9.8	7.7	Silicon Nitride ^d	1.4	—
Aluminum Bronzes (cast) ^a	9.5	9	Silica Glasses ^a	0.5	0.3
Cobalt-Base Superalloys ^d	9.4	6.8	Silica, Vitreous ^a	0.28	—
Beryllium Copper ^a	9.3	—	Wool Felts ^b	0	—

* Values represent high and low sides of a range of typical values. Values for plastics materials are for a range of temperatures between -22 and 86°F (ASTM D696). ^b Value at room temperature only.

^a Value for a temperature range between room temperature and 212-750°F.

^d Value for a temperature range between room temperature and 1000-1800°F.

^e Value for a temperature range between room temperature and 2200-2875°F.

Comparisons
of Materials

Comparisons of Materials

Electrical Resistivity*

Microhm-cm

Material ↓	High	Low	Material ↓	High	Low	Material ↓	High	Low
Polyethylenes, Low Density	10 ²⁵	10 ²³	Cellulose Acetate	10 ¹⁸	10 ¹⁶	Low Alloy Steels (23XX)	28.4	—
Polystyrenes, GP	10 ²⁵	10 ²⁴	Butyrate	10 ¹⁸	10 ¹⁵	Molybdenum	—	—
TFE, FEP Fluorocarbons	10 ²⁵	—	Melamines, Shock Res	10 ¹⁸	—	Disilicide	27.2	21.5
CFE Fluorocarbon	10 ²⁴	—	Phenolics (molded), Very High Shock	10 ¹⁸	—	Hard Leads	27.1	22
Polymethylstyrene	5 x 10 ²³	2.0 x 10 ¹⁸	Polyesters (cast), Nonrigid	10 ¹⁸	—	Vanadium	25	—
Micas	10 ²³	10 ¹⁹	Ureas	5 x 10 ¹⁷	5 x 10 ¹⁶	Low Alloy Steels (41XX)	22.3	—
Modified Polystyrenes	10 ²³	10 ¹⁸	Methylstyrene-Acrylonitrile	2.6 x 10 ¹⁷	—	Low Alloy Steels (51XX, 61XX)	21	—
Polypropylene	>10 ²²	—	Cellulose Nitrate	1.5 x 10 ¹⁷	10 x 10 ¹⁶	Soft Leads	20.6	—
Polystyrenes, Glass-Filled	3.5 x 10 ²²	—	Rubber Phenolics	10 ¹⁷	10 ¹⁵	Low Alloy Steels (cast)	20	15
Polycarbonate	2.1 x 10 ²²	—	Melamines, Glass Fiber-Filled	7 x 10 ¹⁶	—	Tantalum Carbide	20	—
Acrylics, High Impact	2 x 10 ²²	—	Diallyl Phthalate	2.5 x 10 ¹⁶	10 ¹⁴	Carbon Steels	19	14.3
Forsterite	2 x 10 ²²	—	Soda-Lime Glasses ^b	4 x 10 ¹⁵	—	Low Alloy Steels (40XX)	19	—
Polycrystalline Glass	2 x 10 ²²	6.3 x 10 ⁹	Beryllium Carbide	1.1 x 10 ⁶	—	Thorium	18	—
Plastics Laminates, Low Pressure	10 ²²	10 ¹⁷	Carbon	4600	3500	Low Alloy Steels (13XX)	17	—
Polyvinyl Chloride	10 ²²	4 x 10 ¹⁷	Graphite	1300	800	Magnesium Alloys	17	5
Vinylidene Chloride	10 ²²	10 ²⁰	Gray Irons	200	50	Carbon Steels (cast)	16	13
Aluminum Silicate Glass ^b	>10 ²¹	—	Titanium & Its Alloys	176	90	Phosphor Bronzes	16	3.6
Borosilicate Glasses ^b	>10 ²¹	10 ¹⁸	Nickel-Base Super-alloys	148	118	White Metal	15	—
Lead Silicate Glasses ^b	>10 ²¹	10 ²⁰	Heat Resistant Alloys (cast)	112	70	Platinum	14.9	—
Polyethylenes, Medium & High Density	>10 ²¹	—	Titanium Carbide	105	—	Free-Cutting Steels	14.3	—
Silica Glasses ^b	>10 ²¹	—	Cr-Ni-Fe Superalloys ^b	104	91	Columbium	14.2	—
Epoxies (molded)	9 x 10 ²¹	10 ²⁰	Austenitic Nodular Irons	102	—	Tantalum	12.4	—
Nylon, Glass-Filled	5.5 x 10 ²¹	1.5 x 10 ²¹	Age Hardenable Stainless Steels	98	75.7	Wrought Irons	11.97	—
Chlorinated Polyether	5 x 10 ²¹	—	Cobalt-Base Super-alloys	93	23.7	Grade A Tin	11.5	—
Acrylics (cast)	10 ²¹	—	Stainless Steels (cast)	90	71	Palladium ^c	10.8	—
Cellulose Propionate	10 ²¹	10 ¹⁸	Low Expansion Nickel Alloys	81	48	Osmium	9.5	—
Nylons 6 & 11	10 ²¹	10 ¹⁸	Austenitic Stainless Steels	78	69	Admiralty Metal, Ann.	8.9	—
Standard Electrical Ceramics	10 ²¹	10 ¹⁹	Columbium Carbide	74	—	Ruthenium ^c	7.6	—
Cordierite	>10 ²⁰	—	Zirconium & Its Alloys	74	40	Tin & Aluminum	—	—
Polyvinyl Butyral	>10 ²⁰	—	Martensitic Stainless Steels	72	40	Brasses	7.5	6.6
Stellite	>10 ²⁰	—	Nodular Irons	68	66	Leaded Brasses	6.6	4.1
Zircon	>10 ²⁰	—	Ferritic Stainless Steels	67	60	Zinc Alloys (cast)	6.54	6.37
Acrylics, GP	10 ²⁰	—	Nickel & Its Alloys ^c	65.3	8.3	Yellow Brass, Ann.	6.4	—
Alkyds	10 ²⁰	—	Zirconium Carbide	63.4	—	Aluminum & Its Alloys	6.3	2.8
Epoxies (cast), GP & Ht Res	10 ²⁰	10 ¹⁸	Uranium	50	25	Cartridge Brass, 70%, Ann.	6.2	—
Ethyl Cellulose	10 ²⁰	10 ¹⁸	Pearlitic Malleable Irons	41.2	38.2	Zinc, CR	6.1	—
Melamines, GP	10 ²⁰	10 ¹⁸	Cupro-Nickels	37	15	Zinc, HR	6.06	—
ABS Resins	>8 x 10 ¹⁹	0.5 x 10 ¹⁹	Standard Malleable Irons	32	—	Beryllium Copper	5.82	4.82
Silicngnes (molded)	>5 x 10 ¹⁹	>3.4 x 10 ¹⁹	Hafnium ^c	30	—	Tungsten ^c	5.48	—
Acetal	>4 x 10 ¹⁹	—	Low Alloy Steels (43XX, 48XX)	30	—	Low Brass, 80%, Ann.	5.4	—
Nylons 66 & 610	4.5 x 10 ¹⁹	—	Nitriding Steels	29	27	Iridium	5.3	—
Boron Nitride	1.7 x 10 ¹⁹	—	Tin-Lead-Antimony Alloys	28.7	25.6	Molybdenum ^c	5.17	—
Allyls (cast)	>10 ¹⁹	—				Beryllium	5	—
Cellulose Acetate	10 ¹⁹	10 ¹⁶				Rhodium	4.51	—
Melamines, Elec	10 ¹⁹	10 ¹⁷				Red Brass, 85%, Ann.	4.7	—
Phenolics, Elec	10 ¹⁹	6 x 10 ¹⁸				Commercial Bronze, 90%, Ann.	3.9	—
Phenolics (molded), GP	10 ¹⁹	10 ¹⁵				Gilding, 95%, Ann.	3.1	—
Polyesters (cast), Rigid	10 ¹⁹	—				Gold ^c	2.35	—
Phenolics (cast), Mech & Chem	7 x 10 ¹⁸	10 ¹⁸				Copper	2.03	1.71
						Silver	1.59	—

* Values represent high and low sides of a range of typical values at room temperature except where noted.

^b At temperatures between 120 and 212 F.

^c At 32 F.

Dielectric Strength of Nonmetallics*

v/mil

Material ↓	High	Low	Material ↓	High	Low	Material ↓	High	Low
Micas, Natural & Synthetic	2000	1000	Nylons 6 & 11	500	420	Polyvinyl Butyral	400	—
Polymethylstyrene	1950	890	Polyesters (cast), Allyl Type	500	330	Silicones (molded)	400	250
Polyvinyl Chloride	1400	24	TFE Fluorocarbons	500	400	Ureas	400	300
Plastics Laminates, High Pressure	1000	70	Polyethylenes	480	—	Rubber Phenolics	375	250
Polypropylene	820	769	Nylons 66 & 610	470	385	Melamines, Shock Res	370	130
Plastics Laminates, Low Pressure	800	100	Epoxies (molded)	468	334	Phenolics (molded), Very High Shock	370	200
Modified Polystyrenes	650	300	Cellulose Propionate	450	300	Alkyds	350	300
Methylstyrene-Acrylonitrile	610	—	Diallyl Phthalate	450	275	Polycrystalline Glass	350	250
Cellulose Acetate	600	250	Phenolics (cast), GP Decorative	450	300	Phenolics, Ht Res	350	100
Cellulose Nitrate	600	300	Melamines, Elec	430	350	Melamines, GP	330	310
CFE Fluorocarbons	600	530	Phenolics (molded), GP	425	200	ABS Resins, Extra High Impact	312	—
Hard Rubber	600	344	Polystyrenes, Glass-Filled	425	340	Alumina Ceramics	300	200
Mica, Glass-Bonded	600	270	ABS Resins, High Impact	416	350	Standard Electrical Ceramics	300	55
Polyvinyl Formal	600	400	Cellulose Acetate Butyrate	400	250	Zircon	290	60
Polyesters (cast), Rigid	570	340	Chlorinated Polyether	400	—	Steatite	280	145
Epoxies (cast)	550	350	Melamines, Cellulose Elec	400	350	Forsterite	250	—
Polystyrenes, GP	>500	—	Phenolics (cast), Mech & Chem	400	350	Phenolics (cast), GP Transparent	250	75
Acetal	500	—	Polycarbonate	400	—	Cordierite	230	140
Acrylics	500	400	Polyesters (cast), Non-rigid	400	220	Polyethylene Foam, Flexible	220	—
Ethyl Cellulose	500	350						
Nylon, Glass-Filled	500	400						

* Values represent high and low sides of a range of typical values.

Dielectric Constant of Nonmetallics*

Material ↓	High	Low	Material ↓	High	Low	Material ↓	High	Low
Mica, Glass-Bonded	40	6.9	Borosilicate Glass	5.1	4	Modified Polystyrenes, Extra High Impact	3.3	1.9
Phenolics (cast)	11	4	Silicones (molded)	5.1	3.6	Polyvinyl Butyral	3.3	—
Alumina Ceramics	9.6	8.2	Alkyds, GP	5	4.8	Acrylics	3.2	2.7
Lead Silicate Glass	9.5	6.6	Rubber Phenolics	5	—	Polyvinyl Formal	3	—
Zircon	9.2	5.3	Vinylidene Chloride	5	3	Polycarbonate	2.96	—
Polyvinyl Chloride	9.1	2.3	Hard Rubber	4.95	2.90	Methylstyrene-Acrylonitrile	2.81	—
Micas, Natural & Synthetic	8.7	5.4	Polyesters (cast), Allyl Type	4.8	3.3	Chlorinated Polyether	2.8	—
Phenolics (molded)	8	4	Alkyds, Elec & Impact	4.5	4.2	Epoxies, Resilient	2.8	2.6
Soda-Lime Glass	7.4	7.2	Diallyl Phthalate	4.5	3.3	Polystyrenes, GP	2.65	2.45
Melamines	7.2	4.7	Nylons 6 & 11	4.5	3.5	Polymethylstyrene	2.48	—
Cellulose Acetate	7	3.2	Epoxies (cast)	4.4	2.6	CFE Fluorocarbons	2.37	2.30
Standard Electrical Ceramics	7.0	5.4	Epoxies, GP	4.4	3.4	Polyethylenes	2.3	—
Ureas	6.9	6.4	Boron Nitride	4.2	—	Polypropylene	2.1	2
Plastics Laminates, High Pressure	6.8	3.3	ABS Resins, Low Temp Impact	4.1	2.8	TFE Fluorocarbons	2	—
Forsterite	6.5	6.2	Epoxies, Ht Res	4	3.5	Prefoamed Epoxy, Rigid	1.55	1.19
Steatite	6.5	5.5	Modified Polystyrenes	4	2.5	Polyethylene Foam, Flexible	1.49	—
Cellulose Nitrate	6.4	—	Polyesters (cast), Rigid	4	2.8	Urethane Rubber	1.40	1.05
Aluminum Silicate Glass	6.3	—	Nylon, Glass-Filled	3.9	3.4	Foamed-in-Place, Rigid	1.40	1.05
Cellulose Acetate Butyrate	6.2	3.2	Silica Glass	3.8	—	Silicone Foams, Rigid	1.26	1.23
Cordierite	6.2	4	ABS Resins, Extra High Impact	3.78	—	Polystyrene Foamed-in-Place, Rigid	1.19	—
Polyesters (cast), Non-rigid	6.1	3.7	Acetal	3.7	—	Prefoamed Cellulose Acetate, Rigid	1.12	1.10
Plastics Laminates, Low Pressure	5.6	3.4	ABS Resins, High Impact	3.6	2.8	Prefoamed Polystyrene, Rigid	<1.07	—
Polycrystalline Glass	5.6	—	Cellulose Propionate	3.6	3.4			
			Ethyl Cellulose	3.6	2.8			
			Nylons 66 & 610	3.6	3.4			
			Polystyrenes, Glass-Filled	3.41	2.74			

* Values represent high and low sides of a range of typical values at 10⁶ cycles.

Comparisons of Materials

Comparisons of Materials

Melting Points of Metals and Ceramics*

Fahrenheit

Material ↓	High	Low	Material ↓	High	Low	Material ↓	High	Low
Tungsten	6152	—	Carbon Steels	2775	2700	Phosphor Bronzes	1970	1550
Thoria	6000	—	Low Alloy Steels	2760	2600	Gilding, 95%	1950	1920
Tantalum	5425	—	Heat Resistant Alloys			Gold	1945	—
Magnesia	5070	—	(cast)	2750	2350	Aluminum Bronzes (cast)	1937	1880
Osmium	4890	—	High Temperature Steels	2750	2660	Commercial Bronze	1910	1870
Molybdenum	4760	—	Stainless Steels (cast)	2750	2550	Leaded Brasses	1900	1610
Calcia & Zirconia	4710	—	Wrought Irons	2750	—	Tin Bronzes (cast),		
Beryllia	4620	—	Cobalt	2723	—	Leaded	1830	1570
Ruthenium	4530	—	Cr-Ni-Fe Superalloys	2664	2225	Beryllium Copper	1800	1600
Iridium	4450	—	Austenitic Stainless			Tin Bronzes (cast), High		
Columbium	4379	—	Steels	2650	2500	Leaded	1800	1700
Molybdenum Disilicide	3775	3595	Nickel & Its Alloys	2635	2300	Tin & Aluminum Brasses	1780	1590
Rhodium	3571	—	Low Expansion Nickel			Silver	1761	—
Silicon Nitride	3452	—	Alloys	2606	2600	Aluminum Silicate Glass	1675	—
Hafnium	3400	—	Nickel-Base Superalloys	2600	2318	Borosilicate Glass	1500	1300
Alumina Cermets	3362	—	Cobalt-Base Superalloys	2570	1600	Soda-Lime Glass	1330	1285
Zirconium & Its Alloys	3355	3300	Age Hardenable Stainless			Aluminum & Its Alloys	1215	935
Platinum	3224	—	Steels	2550	2500	Magnesium Alloys	1200	830
Thorium	3180	—	Cr-Ni-Co-Fe Superalloys	2470	2350	Aluminum & Its Alloys		
Titanium & Its Alloys	3135	2730	Beryllium	2341	—	(cast)	1195	910
Vanadium	3110	—	Cupro-Nickels	2260	2020	Lead Silicate Glasses	1160	1075
Fused Silica Glass	3050	—	Austenitic Nodular Irons	2250	—	Tin-Lead-Antimony Alloys	792	358
Boron Nitride	>3000	—	Chromium Copper	2147	—	Zinc & Its Alloys	792	727
Palladium	2829	—	Uranium	2071	—	Soft Lead	623	617
Martensitic Stainless			Heat Resistant Nodular			Hard Lead Alloys	610	490
Steels	2800	2500	Irons	2150	2050	Pewter	565	475
96% Silica Glass	2800	—	Nickel Silvers	2030	1870	Lead-Base Babbitts	540	460
Ferritic Stainless			Silicon Bronzes	1990	1780	White Metal	475	—
Steels	2790	2600	Coppers	1981	1949	Hard Tin	443	—

*Values represent high and low sides of a range of typical values.

Maximum Service Temperatures of Plastics and Rubber*

Fahrenheit

Material ↓	High	Low	Material ↓	High	Low	Material ↓	High	Low
Silicones (molded)	>700	>600	Prefoamed Cellulose			Butadiene-Acrylonitrile		
TFE Film	585	566	Acetate, Rigid	350	200	Foams	210	—
Silicone Rubber	550	—	Alkyds, GP	345	295	Rubber Hydrochloride		
Plastics Laminates, Low			Alkyds, Elec	300	—	Film	205	—
Pressure	500	250	Allyls (cast)	300	—	Acrylics	200	140
TFE Fluorocarbons	500	—	Butyl Rubber	300	—	Polystyrenes, Glass-		
Polyester Film	490	—	Diallyl Phthalate,			Filled	200	190
Diallyl Phthalate	450	300	Orlon-Filled	300	—	PVC-Nitrile Rubber Blend		
Fluorinated Acrylic			Nylons 66 & 610	300	225	Film	200	—
Rubber	450	—	Phenolic Foamed-in-			Urethane Foams, Flexible	200	—
Phenolics, Shock & Ht			Place, Rigid	300	—	Modified Polystyrenes	190	120
Res	450	250	Polypropylene Film	300	—	Acetal	185	—
Viton Rubber	450	—	Rubber Phenolics	300	212	Polystyrene Foamed-in-		
Cellulosic Films	400	140	Plastics Laminates,			Place, Rigid	185	—
Epoxies (cast), Ht Res	400	—	GP	295	245	Natural Rubber	180	—
FEP Fluorocarbons	400	—	Polyester (cast), Rigid	295	245	Neoprene Foams	180	—
Melamines, Glass-Filled	400	300	Polyvinylidene Chloride			Polystyrenes, GP	180	140
Nylon, Glass-Filled	400	300	Film	290	—	Polyvinyl Chloride Film,		
Phenolics (molded),			Melamines, Fabric-Filled	250	—	Nonrigid	180	150
Shock & Heat	400	350	Melamines, Shock Res	250	—	Styrene-Butadiene		
Plastics Laminates, Elec	400	160	Nitrile Rubber	250	—	Rubber	180	—
Urethane Foamed-in-			Nylons 6 & 11	250	200	Epoxies (cast), GP	175	—
Place, Rigid	400	—	Polyethylene Film	250	200	Prefoamed Polystyrene,		
CFE Film	395	300	Polysulfide Rubber	250	—	Rigid	175	155
Melamines, Cellulose or			Neoprene Rubber	240	—	Polyvinyl Formal	165	130
Mineral-Filled	395	205	Urethane Rubber	240	—	Butadiene-Styrene Foams	160	—
CFE Fluorocarbons	380	—	Polyvinyl Chloride	220	140	Natural Rubber Foam	160	—
Nylon 6 Film	380	—	Methylstyrenes	212	210	Cellulose Nitrate	140	120
Alkyds, High Str	350	—	Vinylidene Chloride	212	170	Epoxies (cast), Resilient	122	—
Phenolics (molded), GP	350	300	Melamines, GP	210	—	Polyvinyl Butyral	115	—

*Values represent high and low sides of a range of typical values.

Specific Heat*

Btu/lb/°F

Material ↓	High	Low	Material ↓	High	Low
Nylon 6 & 11	0.6	0.4	Low Expansion Nickel Alloys	0.123	0.120
Allyl (cast)	0.56	0.26	Austenitic Stainless Steels	0.12	—
Polyester, Rigid	0.56	0.30	Cobalt-Base Superalloys	0.12	0.09
Polyethylenes	0.55	0.46	Ferritic Stainless Steels	0.12	0.11
Nylon 66 & 610	0.5	0.3	Low Alloy Steels	0.12	0.10
Polypropylene	0.46	—	Nitriding Steels	0.12	0.11
Beryllium	0.45	—	Vanadium	0.12	—
Cellulose Acetate	0.42	0.3	Carbon Steels	0.11	0.10
Cellulose Acetate Butyrate	0.4	0.3	Cr-Ni-Fe Superalloys	0.11	0.10
Cellulose Propionate	0.4	0.3	Free-Cutting Steels	0.11	0.10
Phenolics, GP	0.40	0.36	Low Alloy Steels (cast)	0.11	0.10
Polyvinyl Butyral	0.4	—	Martensitic Stainless Steels	0.11	—
ABS Resins	0.38	0.35	Nickel-Base Superalloys	0.11	0.09
Acetal	0.35	—	Wrought Irons	0.11	—
Acrylics	0.35	0.34	Inconel	0.109	—
Modified Polystyrenes	0.35	0.30	Cr-Ni-Co-Fe Superalloys	0.108	0.10
Nylon, Glass-Filled	0.35	0.30	Beryllium Copper	0.10	—
Phenolics, High Shock	0.35	0.31	Copper Alloys	0.10	0.09
Polystyrene, GP	0.35	0.33	Nickel & Its Alloys	0.10	0.13
Rubber Phenolics	0.33	—	Zinc & Its Alloys	0.10	0.95
Silicon Carbide	0.33	0.29	Cupro-Nickels	0.09	—
Phenolics, Very High Shock	0.32	0.28	Leaded Brasses	0.09	—
Vinylidene Chloride	0.32	—	Nickel Silvers	0.09	—
Polyvinyl Alcohol	0.3	—	Phosphor Bronzes	0.09	—
Polystyrenes, Glass-Filled	0.27	0.24	Plain Brasses	0.09	—
Prefoamed Polystyrene, Rigid	0.27	—	Silicon Bronzes	0.09	—
Micas	0.25	0.13	Tin & Aluminum Brasses	0.09	—
TFE Fluorocarbons	0.25	—	Zircon & Its Alloys	0.07	—
Magnesium Alloys	0.245	—	Columbium	0.065	—
Aluminum & Its Alloys	0.23	0.22	Molybdenum	0.65	—
CFE Fluorocarbons	0.22	—	Tin-Lead-Antimony Alloys	0.065	—
Borosilicate Glass	0.2	—	Rhodium	0.059	—
Soda-Lime Glass	0.2	—	Palladium	0.058	—
Fused Silica Glass	0.19	—	Ruthenium	0.057	—
Polycrystalline Glass	0.19	0.18	Silver	0.056	—
Aluminum Silicate Glass	0.18	—	Tin & Its Alloys	0.05	—
Carbon	0.18	—	Tantalum	0.036	—
Graphite	0.18	—	Hafnium	0.035	—
96% Silica Glass	0.18	—	Tungsten	0.034	—
Lead Silicate Glass	0.17	0.16	Lead & Its Alloys	0.032	0.031
Alumina Cermets	0.16	0.14	Gold	0.031	—
Heat Resistant Alloys (cast)	0.14	0.11	Iridium	0.031	—
Stainless Steels (cast)	0.14	0.11	Osmium	0.031	—
Malleable Irons	0.13	—	Platinum	0.031	—
Titanium & Its Alloys	0.13	0.12	Thorium	0.03	—
Monel	0.127	—	Uranium	0.03	—

* Values represent high and low sides of a range of typical values.

Comparison
of Materials

Comparisons of Materials

Modulus of Elasticity in Tension*

100,000 psi

Material ↓	High	Low	Material ↓	High	Low
Tungsten Carbide Cermet	943	616	Tellurium Copper	160	—
Tungsten-Titanium Carbide Cermet	806	655	Tin & Aluminum Brasses	160	150
Osmium	800	—	Zirconium & Its Alloys	140	138
Iridium	740	—	Aluminum Silicate Glass	127	—
Silicon Carbide	680	132	Boron Nitride	124	—
Ruthenium	600	—	Gold	120	—
Titanium Carbide Cermet	570	420	Mica, Glass-Bonded	120	70
Alumina Ceramics	500	320	Silver	110	—
Tungsten	500	—	Aluminum & Its Alloys	106	100
Beryllium	440	—	Fused Silica Glass	102	—
Boron Carbide	420	—	Soda-Lime Glass	100	90
Molybdenum	420	—	Standard Electrical Ceramics	100	—
Rhodium	420	—	Thorium	100	—
Alumina Cermets	410	370	Borosilicate Glass	98	68
Cobalt-Base Superalloys	360	270	96% Silica Glass	97	—
High Temperature Steels	316	290	Lead Silicate Glass	90	76
Cr-Ni-Co-Fe Superalloys	311	288	Pewter	77	—
Inconel	310	—	Tin-Base Babbitts	76	72
Carbon Steels	300	290	Cordierite	70	—
Cobalt (cast)	300	—	Grade A Tin	65	60
Low Alloy Steels (cast)	300	290	Magnesium Alloys	65	64
Mica, Natural	300	200	Phenolics, Elec	50	30
Nickel & Its Alloys	300	190	Lead-Base Babbitts	42	—
Nitriding Steels	300	290	Nickel-Base Superalloys	35.5	28
Ultra High Strength Steels	300	294	Phenolics, Shock & Ht Res	33	8
Uranium	300	—	Lead & Its Alloys	20	15
Cr-Ni-Fe Superalloys	299	280	Melamines, Filled	19.5	9.9
Wrought Irons	295	—	Titanium & Its Alloys	17.5	13
Age Hardenable Stainless Steels	294	280	Ureas	16	13
Austenitic Stainless Steels	290	280	Phenolics, GP	13	7
Ferritic Stainless Steels	290	—	Polystyrenes, Glass-Filled	13	11
Free-Cutting Steels	290	—	Tin Bronzes (cast), High Leaded	13	8.5
Heat Resistant Alloys (cast)	290	250	Diallyl Phthalate	12	6
Martensitic Stainless Steels	290	—	Rubber Phenolics	9	3
Stainless Steels (cast)	290	240	Nylon, Glass-Filled	8.6	1.2
Pearlitic Malleable Irons	280	—	Polyvinyl Formal	7	5
Tantalum	270	—	Modified Polystyrenes	6	2.5
Monel	260	—	Acrylics, GP	5	3.5
Mica, Synthetic	250	—	Phenolics (cast), Mech & Chem	5	4
Standard Nodular or Ductile Irons	250	185	Polystyrenes, GP	5	4
Standard Malleable Irons	250	—	Phenolics (cast), Decorative	4.5	3
Low Expansion Nickel Alloys	240	210	Nylon 66 & 610	4.1	1.6
Cupro-Nickels	220	180	Polyvinyl Butyral	4	3.5
Platinum	210	—	Nylon 6 & 11	3.6	1.5
Zircon	210	—	Ethyl Cellulose	3.5	0.5
Gray Irons	200	90	Acrylics, High Impact	3	2.2
Hafnium & Vanadium	200	—	Allyls (cast)	3	2
Austenitic Nodular Irons	185	—	CFE Fluorocarbons	3	1.9
Aluminum Bronzes (cast)	180	150	Phenolics (cast), Transparent	3	1
Nickel Silvers	180	175	ABS Resins	2.9	1
Silicon Bronzes	180	150	Carbon	2.3	1.6
Polycrystalline Glass	173	125	Cellulose Nitrate	2.2	1.9
Copper	170	—	Vinylidene Chloride	2	0.7
Gilding, 95% & Commercial	170	—	Graphite	1.8	0.5
Bronze, 90%	170	—	Polypropylene	1.55	—
Leaded Brasses	170	140	TFE Fluorocarbons	0.65	0.38
Palladium	170	—	Polycarbonate	0.33	—
Phosphor Bronzes	170	150	Polyethylene, Low Density	0.27	0.20
Steatite	160	130	Polyvinyl Chloride, Nonrigid	0.030	0.004

* Values represent high and low sides of a range of typical values at room temperature.

Yield Strength of Metals*

1000 psi

Material ↓	High	Low	Material ↓	High	Low
Martensitic Stainless Steels, H & T	275	60	Austenitic Stainless Steels, Ann.	55	30
Ultra High Strength Steels, H & T	250	239	Beryllium, Ann.	55	45
Low Alloy Steels (40XX), H & T	231	85	Chromium Copper, Hard	55	—
Low Alloy Steels (92XX), H & T	226	215	Ferritic Stainless Steels, Ann.	55	35
Age Hardenable Stainless Steels, Sol'n Tr & Aged	225	42	Commercial Bronze, 90%, Hard	54	—
Titanium & Its Alloys, Ht Tr	220	150	Naval Brass, Half Hard	53	—
Low Alloy Steels (41XX), H & T	215	170	Free-Cutting Brass, Half Hard	52	—
Low Alloy Steels (51XX), H & T	208	114	Aluminum & Its Alloys, Hard	50	22
Nitriding Steels, H & T	202	90	Gilding, 95%, Hard	50	—
Low Alloy Steels (43XX), H & T	200	154	Leaded Commercial Bronze, Half Hard	50	—
Low Alloy Steels (86XX, 87XX), H & T	194	98	Sulfur Copper, Half Hard	48	—
High Temperature Steels, H & T	186	117	Aluminum Bronzes (cast)	45	27
Low Alloy Steels (61XX), H & T	179	94	Copper, Hard	45	—
Low Alloy Steels (cast)	170	45	Thorium, CW	45	—
Stainless Steels (cast), H & T	165	67	Zirconium & Its Alloys, Ann.	45	11
Low Alloy Steels (46XX), H & T	160	75	Magnesium Alloys	44	19
Titanium & Its Alloys, Ann.	160	40	Silver, CW	44	—
Nickel-Base Superalloys, Sol'n Tr & Aged	154	92	Tellurium Copper, Half Hard	44	—
Beryllium-Copper, Hard	150	130	Cobalt (cast)	43	20
Carbon Steels, H & T	142	86	Aluminum & Its Alloys (cast), Sol'n Tr & Aged	42	20
Cr-Ni-Fe Superalloys, Sol'n Tr & Aged	142	71	Low Expansion Nickel Alloys, Ann.	40	33
Austenitic Stainless Steels, CW	140	75	Nickel Brasses & Bronzes (cast), Leaded	40	15
Nodular Irons	125	45	Standard Malleable Irons	40	32
Nickel-Base Superalloys (cast)	120	105	Austenitic Nodular Irons	38	32
Nickel & Its Alloys, Ann. & Age Hard	120	90	Beryllium-Copper, Ann.	35	25
Low Alloy Steels (13XX), H & T	118	100	Hafnium, Ann.	32	—
Cobalt-Base Superalloys, Sol'n Tr & Aged	113	67	Gold, CW	30	—
Martensitic Stainless Steels, Ann.	105	25	Magnesium Alloys (cast)	30	8
Free-Cutting Steels, CD	100	60	Nickel Silvers, Ann.	30	18
Low Alloy Steels (25XX), H & T	100	94	Palladium, CW	30	—
Pearlitic Malleable Irons	100	45	Tin & Aluminum Brasses, Ann.	30	22
Zirconium & Its Alloys, CW	98	58	Phosphor Bronzes, Ann.	28	14
Hafnium, CW	96	—	Platinum, CW	27	—
Heat Resistant Nodular Irons	95	45	Wrought Irons, HR	27	—
Cr-Ni-Co-Fe Superalloys, Sol'n Tr & Aged	91	58	Aluminum & Its Alloys (cast)	26	8
Nickel Silvers, Hard	90	74	Tin Bronzes (cast), Leaded	26	16
Yellow Brasses (cast), High Strength	90	25	Thorium, Ann.	26	—
Silicon Bronzes, Hard	88	50	Uranium, Ann.	25	—
Stainless Steels (cast)	85	31	Red Brasses (cast), Leaded	24	12
Carbon Steels, HR	84	29	Aluminum & Its Alloys, Ann.	23	4
Heat Resistant Alloys (cast), Ht Tr	81	43	Cupro-Nickels, Ann.	22	15
Ferritic Stainless Steels, CW	80	45	Tin Bronzes (cast), High Leaded	22	11
Carbon Steels, CW	79	33	Muntz Metal, Ann.	21	—
Phosphor Bronzes, Hard	75	50	Architectural Bronze (extr)	20	—
Zirconium Copper, Hard	75	48	Forging Brass (extr)	20	—
Aluminum & Its Alloys, Sol'n Tr & Aged	73	31	Leaded Brasses, Ann.	20	17
Cupro-Nickels, Hard	73	—	Yellow Brasses (cast), Leaded	20	11
Nickel-Base Superalloys, Sol'n Tr	72	52	Ingot Iron, Ann.	19	—
Aluminum Bronzes (cast), Ht Tr	70	40	Free-Cutting Brass, Ann.	18	—
Carbon Steels (cast)	70	30	Chromium Copper, Ann.	15	—
Low Expansion Nickel Alloys, CW	70	—	Yellow Brass, Ann.	14	—
Ingot Iron, CD	69	—	Low Brass, 80%, Ann.	12	—
Nickel & Its Alloys, Ann.	65	12	Cartridge Brass, 70%, Ann.	11	—
Cartridge Brass, 70%, Hard	63	—	Commercial Bronze, 90%, Ann.	10	—
Tin & Aluminum Brasses, Half Hard	60	53	Copper, Ann.	10	—
Leaded Brasses, Hard	60	52	Gilding, 95%, Ann.	10	—
Manganese Bronze (A), Half Hard	60	—	Red Brass, 85%, Ann.	10	—
Silicon Bronzes, Ann.	60	15	Silver, Ann.	8	—
Yellow Brass, Hard	60	—	Tin & Its Alloys, CR	6	2
Low Brass, 80%, Hard	59	—	Platinum, Ann.	5.5	—
Red Brass, 85%, Hard	57	—	Palladium, Ann.	5	—
			Lead & Its Alloys	1.6	0.8
			Tin & Its Alloys, Ann.	1.3	—

* Values represent high and low sides of a range of typical values at 0.2% offset.

Comparison of Material:

Comparisons of Materials

Tensile Strength*

10000 psi

Material ↓	High	Low	Material ↓	High	Low
Rhodium, CW	300	—	Stainless Steels (cast)	105	69
Tungsten, CW	300	70	Asbestos Fibers	100	80
Ultra High Strength Steels, H & T	295	279	Carbon Steels (cast)	100	60
Martensitic Stainless Steels, H & T	285	90	Columbium, CW	100	—
Low Alloy Steels (40XX), H & T	269	120	Heat Resistant Nodular Irons	100	60
Low Alloy Steels (92XX), H & T	258	232	Silicon Bronzes, Hard	100	70
Age Hardenable Stainless Steels, Sol'n Tr & Aged	240	86	Tantalum, Ann	100	50
Titanium & Its Alloys, Ht Tr	240	160	Aluminum Bronzes (cast)	95	75
High Temperature Steels, H & T	235	139	Carbon Steels, CW	92	56
Aluminum Silicate Fibers	230	50	Beryllium, Ann	90	60
Low Alloy Steels (41XX), H & T	230	200	Ferritic Stainless Steels, CW	90	75
Low Alloy Steels (51XX), H & T	224	143	Polyethylene Fibers	90	11
Glass Fibers	220	200	Silicon Bronzes, Ann	90	40
Low Alloy Steels (43XX), H & T	220	180	Uranium, Ann	90	—
Stainless Steels (cast), H & T	220	110	Ferritic Stainless Steels, Ann	85	65
Low Alloy Steels (86XX, 87XX), H & T	214	122	Plastics Laminates, Low Pressure	85	8
Nitriding Steels, H & T	206	121	Tin & Aluminum Brasses, Half Hard	84	75
Nickel-Base Superalloys, Sol'n Tr & Aged	205	162	Aluminum & Its Alloys, Sol'n Tr & Aged	83	35
Low Alloy Steels (cast)	200	70	Animal Fibers	83	20
Cr-Ni-Fe Superalloys, Sol'n Tr & Aged	196	114	Beryllium-Copper, Ann	80	60
Nickel & Its Alloys, Ann. & Age Hard	190	130	Cupro-Nickels, Hard & Light Drawn	80	60
Carbon Steels, H & T	189	113	Leaded Brasses, Hard	80	55
Low Alloy Steels (61XX), H & T	187	125	Zirconium Copper, Hard	80	56
Austenitic Stainless Steels, CW	185	110	Hafnium, Ann	77	—
Beryllium-Copper, Hard	185	165	Low Expansion Nickel Alloys, Ann	77	68
Low Alloy Steels (46XX), H & T	185	100	Cartridge Brass, 70%, Hard	76	—
Tantalum, CW	180	110	Gray Irons	75	15
Molybdenum, CW	175	120	Low Brass, 80%, Hard	74	—
Titanium & Its Alloys, Ann	170	110	Yellow Brass, Hard	74	—
Cobalt-Base Superalloys, Sol'n Tr & Aged	165	101	Ingot Iron, CD	73	—
Cellulosic Fibers	155	20	Rhodium, Ann	73	—
Cr-Ni-Co-Fe Superalloys, Sol'n Tr & Aged	154	118	Vanadium, Ann	72	—
Nodular Irons	150	60	Red Brass, 85%, Hard	70	—
Nickel & Its Alloys (cast), Ann. & Aged	145	30	Austenitic Nodular Irons	68	58
Tungsten-Titanium Carbide Cermet	145	118	Free-Cutting Brass, Half Hard	68	—
Carbon Steels, HR	142	51	Zirconium & Its Alloys, Ann	68	29
Low Expansion Nickel Alloys, CW	140	90	Phosphor Bronzes, Ann	66	40
Low Alloy Steels (13XX), H & T	137	122	Nickel Brasses & Bronzes (cast), Leaded	65	30
Titanium Carbide Cermet	134	26	Tin & Aluminum Brasses, Ann	65	53
Bast Fibers	132	57	Vanadium, Ann	64	—
Nickel-Base Superalloys, Sol'n Tr	131	114	Nickel Silvers, Ann	63	49
Molybdenum, Ann	130	85	Chromium Copper, Hard	62	—
Nickel-Base Superalloys (cast)	130	117	Commercial Bronze, 90%, Hard	61	—
Phosphor Bronzes, Hard	130	65	Aluminum & Its Alloys, Hard	60	22
Tungsten Carbide Cermet	130	—	Architectural Bronze (extr)	60	—
Nylon Fiber	128	59	Cupro-Nickels, Ann	60	44
Polyester Fibers	126	67	Leaded Brasses, Ann	60	49
Hard Fibers	125	100	Standard Malleable Irons	60	52
Martensitic Stainless Steels, Ann	125	65	Acrylic Fibers	57	26
Low Alloy Steels (25XX), H & T	120	113	Gilding, 95%, Hard	56	—
Nickel & Its Alloys, Ann	120	50	Copper, Hard	55	50
Pearlitic Malleable Irons	120	65	Leaded Commercial Bronze, Half Hard	55	—
Yellow Brasses (cast), High Strength	120	60	Micas, Natural & Synthetic	55	40
Aluminum Bronzes (cast), Ht Tr	115	90	Magnesium Alloys	55	34
Austenitic Stainless Steels, Ann	115	80	Muntz Metal, Ann	54	—
Heat Resistant Alloys (cast), Ht Tr	115	73	Silver, CW	54	—
Vanadium & Hafnium, CW	113	112	Forging Brass (extr)	52	—
Free-Cutting Steels, CD	110	70	Columbium, Ann	50	—
Heat Resistant Steels (cast)	110	65	Sulfur Copper, Half Hard	50	—
Cotton Fiber	109	44	Aluminum & Its Alloys (cast), Sol'n Tr & Aged	49	36
Vanadium, CW	109	—	Free-Cutting Brass, Ann	49	—
Zirconium & Its Alloys, CW	108	82	Thorium, CW	49	—
Nickel Silvers, Hard	105	83	Tellurium Copper, Half Hard	48	—
			Tin Bronzes (cast), Leaded	48	33
			Wrought Irons, HR	48	39

* Values represent high and low sides of a range of typical values at room temperature.

Tensile Strength:

1000 psi

Material ↴	High	Low	Material ↴	High	Low
Zinc & Its Alloys (cast)	4.6	25	Tin & Its Alloys, CR	8.7	2.8
Fluorocarbon Fiber	47	—	Tin & Its Alloys, Ann.	8.6	2.2
Palladium, CW	47	—	ABS Resins	8.5	3
Red Brasses (cast), Leaded	46	29	Cellulose Acetate	8.5	1.9
Yellow Brass, Ann.	46	—	Polyvinyl Butyral	8.5	4
Zinc & Its Alloys, CR	46	21	Polyvinyl Chloride Film, Rigid	8.5	6.5
Aluminum & Its Alloys, Ann.	45	12	Acrylics (cast), GP	8	6
Platinum, CW	45	34	Cellulose Nitrate	8	7
Vinyl Fibers	45	12	Polyethylene Film	8	1.6
Yellow Brasses (cast), Leaded	45	30	Polystyrenes, GP	8	5
Cartridge Brass, 70%, Ann.	44	—	Wood Comp Board (par. to sur), Hard-board	7.8	3
Aluminum & Its Alloys (cast)	43	19	Cellulose Propionate	7.5	1.5
Ingot Iron, Ann.	42	—	Lead & Its Alloys (cast)	7.4	2
Low Brass, 80%, Ann.	42	—	Acrylics, High Impact	7.3	5.5
Zinc & Its Alloys, HR	42	19.5	Diallyl Phthalate	7	4
Magnesium Alloys (cast)	40	23	Electrical Ceramics	7	2.5
Vinylidene Chloride	40	4	Ethyl Cellulose	7	3
Alumina Ceramics	39	20	Mica, Glass-Bonded	7	5
Red Brass, 85%, Ann.	39	—	Cellulose Acetate Butyrate	6.8	1.9
Tin Bronze (cast), High Leaded	38	25	CFE Film	6.6	6.3
Chromium Carbide Cermet	37	36	Chlorinated Polyether	6	—
Commercial Bronze, 90%, Ann.	37	—	Rubber Hydrochloride Film	6	5
Plastic Laminates, High Pressure	37	7	Urethane Rubber (gum)	>5	—
Chromium Copper, Ann.	35	—	CFE Fluorocarbons	5.7	4.6
Copper, Ann.	35	32	Polypropylene	5	—
Cobalt (cast)	34.4	—	Polyvinyl Alcohol	5	1
Gilding, 95%, Ann.	34	—	Polyvinyl Chloride Film, Nonrigid	5	1
Thorium, Ann.	34	—	Silicones (molded)	5	4
Gold, CW	32	—	Wood Comp Board (par. to sur), Particle	5	0.5
Nylon, Glass-Filled	31	19	Lead & Its Alloys (rolled)	4.7	2.4
Palladium, Ann.	30	—	Natural Rubber (black)	4.5	3.5
Polyester Film	28	17	Nitrile Rubber (black)	4.5	3
Platinum, Ann.	26	17	Polyethylene, High Density	4.4	2.9
Silicon Carbide	25	3	Alkyds, GP & Elec	4	3
Boron Carbide	22.5	—	Neoprene Rubber (black)	4	3
Silver, Ann.	22	—	PVC-Nitrile Rubber Blend Film	4	1.5
Alumina Cermets	21	—	Styrene-Butadiene Rubber (black)	3.5	2.5
Cellophane	19	7	TFE Fluorocarbons	3.5	2.5
Gold, Ann.	19	—	Lead & Its Alloys (extr)	3.3	2
Nylon 6 Film	17	13.8	Butyl Rubber (black)	3	2.5
Polystyrenes, Glass-Filled	17	11	Cordierite	3	—
Polyvinylidene Chloride Film	15	7	TFE Film	3	2
Steatite	15	4.8	Polyethylene, Medium Density	2.4	2
Nylon 66 & 610	12.6	7.1	Viton Rubber (gum)	>2	—
Epoxies (cast)	12	0.1	Graphite	2	0.4
Nylon 6 & 11	12	8.5	Wood Comp Board (par. to sur), Soft-board	2	0.2
Polystyrene Film	12	7	Fluorinated Acrylic Rubber (gum)	1.2	—
Zircon	12	4.5	Urethane Foamed-in-Place, Rigid	1.2	0.010
Tin-Lead-Antimony Alloys (cast)	11.8	6.8	Carbon	1.1	0.9
Modified Polystyrenes	11	3	Polysulfide Rubber (gum)	>1	—
Polyvinyl Formal	11	9	Silicone Rubber (gum)	1	0.6
Acrylics (molded, extr)	10.5	5.5	Polyethylene, Low Density	0.9	2.5
Polycarbonate	10.5	9	Wool Felts, Sheet	0.8	0.4
Acetal	10	—	Polyethylene Foam, Flexible	0.67	—
Alkyds, Impact	10	6	Prefoamed Epoxy, Rigid	0.65	0.05
Epoxies (molded)	10	8	Wool Felts, Roll	0.6	0.08
Ethyl Cellulose Film	10	6	Vinyl Foams, Flexible	0.2	0.01
Forsterite	10	—	Prefoamed Polystyrene, Rigid	0.19	0.030
Melamines	10	5	Prefoamed Cellulose Acetate, Rigid	0.18	0.11
Phenolics (molded)	10	3.5	Polystyrene Foamed-in-Place, Rigid	0.13	0.030
Polyesters (cast)	10	0.9	Neoprene Foams	0.1	0.02
Polypropylene Film	10	5	Butadiene-Styrene Foams	0.08	—
Polyvinyl Alcohol Film	10	6	Phenolic Foamed-in-Place, Rigid	0.075	0.004
Ureas	10	5	Butadiene-Acrylonitrile Foams	0.04	—
Hard Rubber	9.3	2	Natural Rubber Foam	0.020	0.010
Methylstyrenes	9.3	6.6			
Phenolics (cast)	9	2.5			
Polyvinyl Chloride	9	1			

* Values represent high and low sides of a range of typical values at room temperature.

Comparisons of Materials

Elongation*

Percent

Material ↓	High	Low	Material ↓	High	Low
Butyl Rubber (black)	850	650	Free-Cutting Brass, Ann.	53	—
Polyethylene Film	800	50	Low Brass, 80%, Ann.	52	—
Urethane Rubber (gum)	750	540	Magnesium Alloys (cast), Sol'n Tr & Aged	51	—
Polyethylene, Low Density	725	80	Thorium, Ann.	51	—
Polypropylene	700	500	Beryllium-Copper, Ann.	50	35
Natural Rubber (black)	650	550	Cellophane	50	15
Nitrile Rubber (black)	650	450	Monel, Ann.	50	24
Polysulfide Rubber (gum)	650	450	Nickel-Base Superalloys, Sol'n Tr	50	43
Neoprene Rubber (black)	600	500	Nickel Silvers, Ann.	50	32
Polyvinyl Alcohol	600	300	Pewter, CR	50	—
Styrene-Butadiene Rubber (black)	600	500	Zinc Alloys, HR	50	10
Polyvinyl Chloride Film, Nonrigid	500	50	Zinc, CR	50	30
PVC-Nitrile Rubber Blend Film	500	250	Cr-Ni-Co-Fe Superalloys, Sol'n Tr & Aged	49	3
Rubber Hydrochloride Film	500	350	Low Expansion Nickel Alloys, Ann.	49	43
Polyvinyl Chloride	450	5	Monel (cast)	49	1
Polyethylene, Medium Density	425	200	Ingot Iron, Ann.	48	—
Polyethylene, High Density	400	12	Red Brass, 85%, Ann.	48	—
Silicone Rubber (gum)	400	60	Silver, Ann.	48	—
Natural Rubber Foam	380	—	Naval Brass, Ann.	47	—
Viton Rubber (gum)	>350	—	Soft Leads (chill cast)	47	39
TFE Fluorocarbons	350	250	Age Hardenable Stainless Steels, Sol'n Tr & Aged	45	3
Nylon 66 & 610	320	60	Aluminum & Its Alloys, Ann.	45	17
Polyesters (cast), Nonrigid	310	30	Commercial Bronze, 90%, Ann.	45	—
Polyethylene Foam, Flexible	310	—	Copper, Ann.	45	35
Fluorinated Acrylic Rubber (gum)	300	—	Cupro-Nickels, Ann.	45	27
Nylon 6 & 11	300	100	Cupro-Nickels, Light Drawn	45	42
Vinyl Foams, Flexible	300	75	Forging Brass (extr)	45	—
TFE Film	250	200	Gilding, 95%, Ann.	45	—
Nylon 6 Film	>200	—	Gold, Ann.	45	—
Polypropylene Film	>200	—	Grade A Tin, Ann.	45	—
ABS Resins	200	5	Modified Polystyrenes	45	1
CPE Film	200	90	Muntz Metal, Ann.	45	—
CPE Fluorocarbons	175	125	Nickel & Its Alloys (cast)	45	1
Chlorinated Polyether	160	60	Acrylic Fibers	42	20
Epoxies (cast)	150	2	Molybdenum, Ann.	42	4
Nickel & Its Alloys, Ann.	130	25	Nylon Fiber	42	16
Polyester Film	130	70	Sulfur Copper, Ann.	42	—
Vinyl Fibers	120	15	Cr-Ni-Fe Superalloys, Sol'n Tr & Aged	41	16
Polycarbonate	100	60	Austenitic Nodular Irons	40	7
Polyethylene Fibers	80	—	Chromium Copper, Ann.	40	—
Lead & Its Alloys (extr)	75	48	Palladium, Ann.	40	24
Cellulose Acetate Butyrate	74	38	Pewter, Ann.	40	—
Cellulose Acetate	70	6	Platinum, Ann.	40	30
Cellulosic Films	70	15	Polyvinylidene Chloride Film	40	25
Phosphor Bronzes, Ann.	70	48	Silicon Bronzes, Hard	40	15
White Metal, Ann.	70	—	Tantalum, Ann.	40	11
Cartridge Brass, 70%, Ann.	66	—	Tin Bronzes (cast), Lead	40	15
Admiralty Brass, Ann.	65	—	Tin Foil, CR	40	—
Yellow Brass, Ann.	65	—	Yellow Brasses (cast), Lead	40	15
Zinc & Its Alloys, HR	65	10	Carbon Steels, HR	39	9
Cobalt-Base Superalloys, Sol'n Tr & Aged	64	2	Wool Felts (at 100 psi), Roll	39	8
Silicon Bronzes, Ann.	63	20	Polyester Fibers	36	9
Titanium Carbide Cermet	61	0	Aluminum Bronzes (cast)	35	7
Austenitic Stainless Steels, Ann.	60	45	Animal Fibers	35	13
Austenitic Stainless Steels, CW	60	8	Carbon Steels, CW	35	20
Cellulose Propionate	60	50	Ethyl Cellulose Film	35	20
Hard Lead (rolled)	60	16	Grade A Tin, CR	35	—
Polyvinyl Butyral	60	5	Heat Resistant Alloys (cast)	35	4
Zinc & Its Alloys, CR	60	10	Martensitic Stainless Steels, Ann.	35	14
Soft Leads (rolled)	57	43	Red Brasses (cast), Lead	35	15
Grade A Tin (cast)	55	—	Yellow Brasses (cast), High Strength	35	12
Lead Brasses, Ann.	55	30			
Stainless Steels (cast)	55	15			

* Values represent high and low sides of a range of typical values at room temperature.

Elongation*

Percent

Material ↓	High	Low	Material ↓	High	Low
Cellulosic Fibers	34	6	Wrought Irons, HR	14	2
Hard Rubber	33	1	Fluorocarbon Fiber	13	—
Manganese Bronze (A), Ann.	33	—	Low Alloy Steels (51XX), H & T	13	—
Carbon Steels (cast)	32	20	Phosphor Bronzes, Hard	13	8
Architectural Bronze (extr)	30	—	Uranium, Ann.	13	—
Cobalt (cast)	30	4	Beryllium-Copper, Hard	12	3
Columbium, Ann.	30	—	Chromium Copper, Hard	12	—
Ferritic Stainless Steels, Ann.	30	20	Ingot Iron, CD	12	—
Martensitic Stainless Steels, H & T	30	2	Leaded Commercial Bronze, Half Hard	12	—
Nickel Brasses & Bronzes (cast), Leaded	30	10	Low Alloy Steels (40XX), H & T	12	8
Soft Leads (sand cast)	30	—	Magnesium Alloys (cast), Sol'n Tr	12	10
Stainless Steels (cast), H & T	30	1	Sulfur Copper, Half Hard	12	—
Vinylidene Chloride	30	15	Tellurium Copper, Half Hard	12	—
Vanadium, Ann.	28	—	Titanium & Its Alloys, Ht Tr	12	3
White Metal, CR	28	—	Ultra High Strength Steels, H & T	12	5.5
Wool Felts (at 100 psi), Sheet	28	2	Aluminum & Its Alloys (cast), Sol'n Tr	10	0.5
Zinc Alloys, CR	28	—	& Aged	10	—
Zirconium & Its Alloys, Ann.	27	22	Hafnium, CW	10	—
Low Alloy Steels (cast)	26	5	Low Alloy Steels (92XX), H & T	10	9
Acrylics (molded, extr)	>25	3	Polystyrene Film	10	3
Ferritic Stainless Steels, CW	25	15	Zinc & Its Alloys (cast)	10	1
High Alloy Steels (cast), Ht Tr	25	4	Zirconium & Its Alloys, CW	10	1.5
Low Alloy Steels (25XX), H & T	25	22	Copper, Hard	10	1.5
Malleable Irons	25	2	Monel, Age H	10	5
Nickel-Base Superalloys, Sol'n Tr & Aged	25	14	Aluminum & Its Alloys (cast)	9	2
Nickel & Its Alloys, Ann. & Age Hard	25	10	Cartridge Brass; 70%, Hard	8	—
Nodular Irons	25	2	Yellow Brass, Hard	8	—
Polypropylene Fiber	25	12	Hard Fibers	7.5	1
Polyvinyl Chloride Film, Rigid	25	5	Low Brass, 80%, Hard	7	—
Standard Malleable Irons	25	10	Cotton Fiber	7	3
Titanium & Its Alloys, Ann.	25	10	Acrylics (cast), GP	7	2
Zirconium Copper, Hard	25	5	Nickel-Base Superalloys (cast)	6	5
Hafnium, Ann.	24	—	Bast Fibers	6	3
Hard Lead Alloys (chill cast)	24	16	Cupro-Nickels, Hard	6	—
Monel, Ann. & Age H	24	14	Beryllium, Ann.	5	2
Carbon Steels, H & T	23	11	Columbium, CW	5	—
Nitriding Steels, H & T	23	15	Commercial Bronze, 90%, Hard	5	—
Aluminum & Its Alloys, Sol'n Tr & Aged	22	11	Gilding, 95%, Hard	5	—
Free-Cutting Steels, CD	22	10	Nickel Silvers, Hard	5	3
Tin-Base Babbitts (die cast)	22	4	Methylstyrenes	5	2.5
Low Alloy Steels (61XX), H & T	21	13	Polyesters (cast), Rigid	5	—
Low Alloy Steels (86XX, 87XX), H & T	21	12	Red Brass, 85%, Hard	5	—
Heat Resistant Nodular Irons	20	0	Gold, CW	4	—
Low Alloy Steels (13XX), H & T	20	19	Hard Rubber, GP	4	2
Low Expansion Nickel Alloys, CW	20	—	Nickel & Its Alloys (cast), Ann. & Aged	4	1
Naval Brass, Half Hard	20	—	Phosphor Bronzes, Spring	4	3
Polyvinyl Formal	20	5	Glass Fibers	3.8	2
Tin Bronzes (cast), High Leaded	20	7	Platinum, CW	3.5	2.5
Inconel (cast)	19	1	Vanadium, CW	3	—
Manganese Bronze (A), Half Hard	19	—	Aluminum Silicate Fibers	2.7	1.4
Magnesium Alloys (cast)	19	3	Hard Rubber, Chem & High Ht Res	2.6	—
Free-Cutting Brass, Half Hard	18	—	Silver, CW	2.5	—
Leaded Brasses, Hard	18	6	Polystyrenes, GP	2.4	1.5
Low Alloy Steels (46XX), H & T	18	14	Nylon, Glass-Filled	2.3	1.5
Low Alloy Steels (48XX), H & T	18	13	Phenolics (molded)	2.25	0.10
High Temperature Steels, H & T	16.5	8	Palladium, CW	1.5	—
Low Alloy Steels (41XX), H & T	16	10	Tantalum, CW	1.5	1
Pearlitic Malleable Irons	16	2	Polystyrenes, Glass-Filled	1.3	1.1
Acetal	15	—	Molybdenum, CW	1	—
Aluminum Bronzes (cast), Ht Tr	15	5	Ureas	1	—
Aluminum & Its Alloys, Hard	15	1.5	Melamines	0.8	0.3
Low Alloy Steels (43XX), H & T	15	12	Cobalt	0.4	—
Magnesium Alloys (forged)	15	7	Chromium Carbide Cermet	0	—
			Tungsten, CW	0	—

* Values represent high and low sides of a range of typical values at room temperature.

Comparisons of Materials

Hardness of Metals*

Brinell

Material ↓	High	Low	Material ↓	High	Low
Martensitic Stainless Steels, H & T	580	180	Standard Malleable Irons	156	110
Low Alloy Steels (40XX), H & T	534	415	Cartridge Brass, 70%, Hard	154	—
Low Alloy Steels (92XX), H & T	514	477	Muntz Metal, Hard	151	—
Stainless Steels (cast), H & T	470	185	Aluminum & Its Alloys, Sol'n Tr & Aged	150	73
Low Alloy Steels (43XX), H & T	445	360	Naval Brass, Hard	150	130
Low Alloy Steels (61XX), H & T	444	429	Nickel Brasses & Bronzes (cast), Leaded	150	50
Low Alloy Steels (51XX), H & T	444	302	Standard Malleable Irons	147	103
Low Alloy Steels (41XX), H & T	444	375	Low Expansion Nickel Alloys, Ann.	144	132
Low Alloy Steels (86XX, 87XX), H & T	423	245	Ingot Iron, CD	142	—
Nitriding Steels, H & T	415	230	Low Carbon Steels, HR	141	119
Low Alloy Steels (cast)	400	150	Aluminum & Its Alloys (cast), Sol'n Tr & Aged	140	80
High Carbon Steels, H & T	390	310	Yellow Brass, Hard	140	—
Low Alloy Steels (46XX), H & T	390	—	Cobalt, Ann.	138	122
Rhodium, CW	390	260	Cobalt (cast)	135	105
Duranickel, Age H	380	300	Low Brass, 80%, Hard	130	—
Low Alloy Steels (48XX), H & T	380	325	Red Brass, 85%, Hard	126	—
Nickel & Its Alloys (cast)	380	80	Palladium, CW	109	—
Nickel & Its Alloys (cast), Ann. & Aged	380	300	Commercial Bronze, 90%, Hard	107	—
Iridium, CW	350	—	Aluminum & Its Alloys, Hard	105	44
Monel, Age H	350	290	Gilding, 95%, Hard	105	—
Osmium (cast)	350	—	Wrought Irons, HR	105	97
Nodular Irons	325	140	Platinum, CW	97	13
Gray Irons	300	170	Zinc Alloys (die cast)	90	82
Heat Resistant Nodular Irons	300	140	Aluminum & Its Alloys (cast)	85	40
High Carbon Steels, HR	289	231	Magnesium Alloys (cast), Sol'n Tr & Aged	84	73
Low Alloy Steels (13XX), H & T	285	248	Muntz Metal, Ann.	82	—
Pearlitic Malleable Irons	285	160	Zinc Alloys, CR	80	60
Nickel Steels, CD	272	188	Tin Bronzes (cast), Leaded	80	60
Heat Resistant Alloys (cast), Ht Tr	270	185	Aluminum & Its Alloys, Ann.	75	23
Martensitic Stainless Steels, Ann.	260	150	Yellow Brasses (cast), Leaded	75	40
Low Alloy Steels (25XX), H & T	244	233	Tin Bronzes (cast), High Leaded	70	35
Austenitic Stainless Steels, CW	240	—	Ingot Iron, Ann.	69	—
Aluminum Bronzes (cast), Ht Tr	235	180	Magnesium Alloys (forged)	69	47
Free-Cutting Steels, CD	230	150	Magnesium Alloys (cast)	65	50
Nickel Steels, HR	225	155	Red Brasses (cast), Leaded	65	50
Yellow Brasses (cast), High Strength	225	80	Magnesium Alloys (cast), Sol'n Tr	63	51
Heat Resistant Alloys (cast)	223	160	Zinc Alloys, HR	61	51
Manganese Steels, Ann.	222	178	Gold, CW	58	—
Ruthenium (cast)	220	—	Platinum, Ann.	52	38
Yellow Brass (cast), High Strength	220	80	Zinc, HR	47	37
Medium Carbon Steels, CW	219	181	Palladium, Ann.	46	—
Nickel-Base Superalloys, Sol'n Tr	218	187	Copper, Ann.	40	—
Medium Carbon Steels, HR	214	166	Silver, Ann.	35	25
Medium Carbon Steels, H & T	213	207	Lead-Base Babbitts (chill cast)	28	14
Stainless Steels (cast), Ann.	210	195	Tin-Base Babbitts (chill cast)	27	17
High Carbon Steels, Ann.	208	192	Gold, Ann.	25	—
Austenitic Nodular Irons	200	140	Pewter (cast)	23	—
Carbon Steels (cast)	200	120	White Metal (cast)	20	—
Aluminum Bronzes (cast)	195	120	White Metal, Ann.	17	—
Copper, Hard	194	—	Hard Lead Alloys (chill cast)	15.4	7
Ferritic Stainless Steels, CW	185	—	Pewter, Ann.	13	—
Austenitic Stainless Steels, Ann.	170	150	Lead & Its Alloys (extr)	12.4	5.1
Iridium, Ann.	170	—	Hard Lead Alloys (rolled)	9.5	5.9
Low Carbon Steels, CW	165	120	Grade A Tin, Ann.	7	—
Manganese Bronze, Half Hard	160	—	Soft Lead (chill cast)	4.2	—
Yellow Brass, Hard	160	—			
Rhodium, Ann.	156	55			

* Values represent high and low sides of a range of typical values.

Hardness of Plastics and Rubber*

Material ↓	High	Low	Material ↓	High	Low
ROCKWELL M HARDNESS			ROCKWELL R HARDNESS		
Melamines.....	M125	M110	Cellulose Acetate.....	R121	R39
Phenolics, Elec.....	M120	M100	Acetal.....	R120	—
Phenolics (cast), Mech & Chem.....	M120	M92	Cellulose Propionate.....	R120	R20
Phenolics, GP.....	M120	M108	Ethyl Cellulose.....	R120	R70
Phenolics, Shock & Ht Res.....	M120	M92	ABS Resins.....	R118	R30
Plastics Laminates, High Pressure.....	M120	M70	Nylon 6, 11, 66, & 610.....	R118	R103
Plastics Laminates, Low Pressure.....	M120	M80	Polycarbonate.....	R118	—
Ureas.....	M120	M116	Cellulose Nitrate.....	R115	R95
Allyls (cast).....	M118	M92	CFE Fluorocarbons.....	R115	R110
Polyesters (cast), Rigid.....	M115	M65	Cellulose Acetate Butyrate.....	R114	R59
Epoxies (cast).....	M110	M76	Diallyl Phthalate.....	R108	R107
Epoxies (molded).....	M110	—	Chlorinated Polyether.....	R100	—
Diallyl Phthalate.....	M108	M100	Polystyrenes, Glass-Filled.....	R100	R90
Acrylics.....	M103	M80	Polypropylene.....	R95	R85
Nylons, Glass Fiber-Filled.....	M95	M85	DUROMETER A HARDNESS		
Polystyrene, Glass Fiber-Filled.....	M90	M80	Hard Rubber.....	A95	A50
Rubber Phenolics.....	M90	M40	Neoprene & Nitrile Rubber.....	A95	A40
Silicones (molded), GP.....	M89	—	Butyl Rubber.....	A90	A40
Modified Polystyrenes, Ht & Chem Res.....	M88	M78	Natural Rubber.....	A90	A30
Polymethylstyrene.....	M86	M76	Styrene-Butadiene Rubber.....	A90	A40
Polyvinyl Formal.....	M85	—	Viton Rubber.....	A90	A60
Methylstyrene-Acrylonitrile.....	M83	—	Polysulfide Rubber.....	A85	A40
Modified Polystyrenes, Impact Res.....	M80	M15	Silicone Rubber.....	A85	A40
Polystyrenes, GP.....	M80	M68	Fluorinated Acrylic Rubber.....	A55	—
Vinylidene Chloride.....	M65	M50	Urethane Rubber.....	A55	—
Silicones (molded), Impact Res.....	M45	—			

* Values represent high and low sides of a range of typical values; no relationship between different scales is implied.

Hardness of Nonmetallics (exc Plastics & Rubber)*

Knoop

Material ↓	High	Low	Material ↓	High	Low
Cubic Boron Nitride.....	7000	—	Zirconium Boride.....	1560	—
Diamond.....	7000	—	Chromium Carbide.....	1300	—
Boron Carbide.....	2800	—	Beryllia.....	1220	—
Titanium Boride.....	2720	—	Molybdenum Disilicide.....	1065	850
Silicon Carbide.....	2500	—	Quartz.....	800	—
Titanium Carbide.....	2460	—	Polycrystalline Glass.....	703	698
Beryllium Carbide.....	2300	—	Glasses.....	500	300
Zirconium Carbide.....	2090	—	Mica, Synthetic.....	200	—
Tantalum Carbide.....	2050	—	Calcite.....	130	—
Columbium Carbide.....	1880	—	Mica, Natural.....	90	—
Tungsten Carbide.....	1880	—	Gypsum.....	30	—
Cemented Carbides.....	1800	1400	Forsterite.....	7.5	—
High Alumina Ceramics.....	1750	1450	Cordierite.....	7	—

* Values represent high and low sides of a range of typical values.

Impact Strength of Metals*

Notched Izod, ft-lb

Material ↓	High	Low	Material ↓	High	Low
Austenitic Stainless Steels, Ann.	165	80	Low Alloy Steels (61XX), H & T	28	13
Austenitic Stainless Steels, CW	90	—	Ferritic Stainless Steels, Ann.	25	2
Martensitic Stainless Steels, Ann.	90	2	Low Alloy Steels (41XX), H & T	25	12
Low Alloy Steels (25XX), H & T	85	80	High Carbon Steels, H & T	22	5
Nitriding Steels, H & T	80	65	White Metal (cast)	22	—
Low Alloy Steels (86XX, 87XX), H & T	76	18	Carbon Steels (cast), Norm. & T	20	—
Martensitic Stainless Steels, H & T	75	2	High Carbon Steels, HR	18	4
Low Alloy Steels (46XX), H & T	68	25	Low Alloy Steels (51XX), H & T	16	6
Nickel-Base Superalloys	62	21	Tin Bronzes (cast), Leaded	16	7
Silicon Bronzes, Ann.	45	42	Tin (cast)	14	—
Low Alloy Steels (48XX), H & T	44	28	Low Alloy Steels (92XX), H & T	12	6
Yellow Brasses (cast), High Strength	40	7	Red Brasses (cast), Leaded	12	6
Low Alloy Steels (43XX), H & T	32	16	Tin Bronzes (cast), High Leaded	8	2
Cobalt-Base Superalloys, Sol'n Tr & Aged	31	4	Magnesium Alloys, Sol'n Tr	5	4
Carbon Steels (cast), Ann.	30	—	Magnesium Alloys (forged)	5	3
			Tin-Lead-Antimony Alloys (cast)	2.5	1
			Magnesium Alloys (cast), Sol'n Tr	2	1

* Values represent high and low sides of a range of typical values. (below) because the methods of computing test results differ.

Values in this table are not directly comparable to those for Plastics

Impact Strength of Plastics

Notched Izod, ft-lb/in.

Material ↓	High	Low	Material ↓	High	Low
Phenolics (molded), Very High Shock	33	10	Modified Polystyrenes, High Impact	3	1
Polyvinyl Formal	20	0.8	Plastics Laminates, Mech	3	0.2
Silicones, High Impact	20	15	Cellulose Acetate, Hard	2.7	0.4
Plastics Laminates, Low Pressure	18	7	Prefoamed Polystyrene, Rigid	2.7	0.5
Nylon, Soluble	>16	—	Rubber Phenolics	2.3	0.3
Polycarbonate	16	12	Nylon 66 & 610	2	0.6
Plastics Laminates, GP	14.4	1	Epoxies (cast), Ht Res	1.5	0.2
Plastics Laminates, Elec	14	6	Melamines, Shock Res	1.5	0.5
Polyethylenes, High Density	14	0.4	Acetal	1.4	—
Alkyds, Impact	12	8	Diallyl Phthalate, Orlon-Filled	1.2	0.5
Melamines, Glass Fiber-Filled	12	4	Polyvinyl Chloride	1.2	0.25
Cellulose Propionate	11	0.8	Polypropylene	1.02	—
Modified Polystyrenes, Extra High Impact	11	6	Polyvinyl Butyral	1.02	0.74
ABS Resins, Low Temp Impact	10	6	Acrylics (molded, extr)	0.8	0.2
ABS Resins, Extra High Impact	9	5	Epoxies (molded)	0.8	0.3
Vinylidene Chloride	8	2	Epoxies (cast), GP	0.7	0.2
Polyesters (cast), Nonrigid	>7	—	Acrylics (cast)	0.5	0.4
Cellulose Nitrate	7	5	Phenolics (molded), GP	0.50	0.24
Epoxies (cast), Resilient	7	0.5	Diallyl Phthalate, Asbestos-Filled	0.45	0.30
Ethyl Cellulose, High Impact	7	3.6	Phenolics (cast)	0.45	0.23
Polystyrenes, Glass-Filled	6.1	4.1	Chlorinated Polyether	0.4	—
ABS Resins, High Impact	6	0.5	Melamines, Elec	0.40	0.28
Diallyl Phthalate, Glass Fiber-Filled	6	0.5	Methylstyrene-Acrylonitrile	0.40	—
Ethyl Cellulose, GP	6	1.8	Modified Polystyrenes, Ht & Chem Res	0.4	0.26
Cellulose Acetate Butyrate	5.4	0.6	Polyesters (cast), Rigid	0.40	0.18
Cellulose Acetate, Soft	5.2	1.7	Alkyds, GP & Elec	0.35	0.30
Nylon, Glass-Filled	5	2.5	Melamines, GP	0.35	0.24
Diallyl Phthalate, Dacron-Filled	4.5	1.7	Polystyrenes, GP	0.35	0.25
Cellulose Acetate, Medium	4	1.1	Ureas	0.35	0.24
TFE & CFE Fluorocarbons	4	2.5	Allyls (cast)	0.32	0.18
Nylon 6	3.6	1.2	Silicones, GP	0.30	0.25
Phenolics (molded), Heat & Shock	3.5	0.27	Vinylidene Chloride, Oriented	0.05	—

Creep Strength of Metals

Material ↓	Form, Condition	Stress (1000 psi) for 0.01% Creep per 1000 Hr at Indicated Temp (F)					Stress (1000 psi) for 0.1% Creep per 1000 Hr at Indicated Temp (F)				
Up to 800 F		300	400	500	600	800	300	400	500	600	800
NONFERROUS METALS											
Coppers	Wrought (annealed)	3-8	1.5-5	0.4-2.6	—	—	—	—	—	—	—
Nonlead Brasses	Wrought (annealed)	0.9-19	2-11	0.3-23	—	—	25	5-9	1-2	—	—
Bronzes	Wrought (annealed)	14-23	5-10	2-5	—	—	—	—	—	—	—
Cupro-Nickel	Wrought (water quenched, aged)	25-40	15-30	8-30	—	—	—	22	13	—	—
Aluminum 2024-T	Sheet	23	9.5	2.5	1.5	—	30	13	3	2	—
Aluminum 7075-T	Sheet	12	4	2.5	1.5	—	16	6	3	2	—
Titanium (commercial)	Sheet (annealed)	—	38	—	32	10	37	40	37	32	13
Ti-6Al-4V	Sheet (annealed)	—	—	—	—	—	—	—	—	80	—
Ti-7Al-4Mo	Bar or Forging (annealed)	—	—	—	—	—	—	—	—	85	18
Above 800 F		1000	1100	1200	1500	1600	1000	1100	1200	1500	1600
CARBON AND LOW ALLOY STEELS											
Low Carbon Steel	Wrought, Cast	1.8	—	0.1	—	—	3.3-5	—	0.5	—	—
Carbon-Molybdenum Steels	Wrought, Cast	5-7	3	1	—	—	10-12	4	2	—	—
Chromium-Molybdenum Steels (0.5-3%)	Wrought, Cast	6-12	2-4	1-2.5	—	—	10-20	3-8	2-4.5	—	—
Chromium Steels 4-6%	Wrought, Cast	6-7	2.5-3.5	1-2	—	—	8-11	5-6.5	2-3.5	—	—
6-10%	Wrought, Cast	5-9	2.5-4	1-2	—	—	8-12	4-6	2.5-3	—	—
STAINLESS STEELS											
Martensitic Chromium Steels (403, 410, 416, 420)	Wrought	8	3.5	1.3	—	—	9.2	4.2	2	—	—
Ferritic Chromium Steels (405, 430, 440)	Wrought	4.2-7	2.3-4.5	1.0-1.6	—	—	6-8.5	3-5	1.5-2.2	—	—
Nickel-Chromium Steels 304, 316, 321, 347	Wrought	12-17	7.5-11.5	4.5-7	1-2	—	17-25	12-18.2	7-12.7	1.2-2.8	—
309	Wrought	—	—	4	0.5	—	15.9	11.6	8	1.0	—
310, 314	Wrought	17	13	8	2	—	17	13-14	9	1-2.5	—
HEAT RESISTANT CAST HIGH ALLOYS											
Iron-Chromium Alloys (HA, HC, HD)	Cast	—	—	—	—	—	—	—	—	1.2-3.5 ^a	0.7-1.9
Iron-Chromium-Nickel Alloys (HE, HF, HH, HI, HK, HL)	Cast	—	—	—	—	—	—	—	—	3.5-7 ^a	2-4.3
Nickel-Chromium Alloys (HN, HT, HU, HW, HX)	Cast	—	—	—	—	—	—	—	—	6-8.5 ^a	3-5
SUPERALLOYS											
Inconel X		—	—	—	—	—	—	—	64	12.3	9.0
19-9 DL		—	—	—	—	—	—	—	20	7.1	2.4
Hastelloy X		—	—	—	—	—	—	—	—	—	—
N-155		—	—	—	—	—	—	—	18.4 ^b	10.3	—
S-816		—	—	—	—	—	—	—	42	11.5	5.8

* At 1400 F. ^b At 1350 F.

Stress-Rupture Strength of High Temperature Alloys

10 Hr

100 Hr

1200 F		1500 F		1800 F		1200 F		1500 F		1800 F	
Alloy	Stress, 1000 psi	Alloy	Stress, 1000 psi	Alloy	Stress, 1000 psi	Alloy	Stress, 1000 psi	Alloy	Stress, 1000 psi	Alloy	Stress, 1000 psi
Waspaloy.....	130	Inconel 713 ^a ..	70	Mo-0.5 Ti ^d ...	65	1753.....	115	Nicrotung ^a ...	65	Mo-0.5 Ti-	
M-252.....	120	René 41.....	65	Columbium ^d ..	53	Waspaloy.....	110	Inconel 713C ^a ..	55	0.07 Zr ^a	70
Incoloy 901 ^b ..	110	U-500.....	62	Molybdenum ^d ..	30	Inconel 700...	100	1753.....	47	Mo-0.5 Ti ^a	62
W-545.....	95	1753.....	60	Inconel 713 ^a ..	24	U-212.....	100	René 41.....	45	Mo-0.5 Ti-	
Inconel X.....	92	Waspaloy.....	58	GMR-235 ^{a, b} ..	16	M-252.....	98	Udimet 500...	45	0.07 Zr ^d	40
Refractaloy 26	92	Inconel 700 ^b ..	55	1753.....	16	D979.....	94	Inconel 700...	43	Columbium ^d ..	36
S-816.....	83	GMR-235 ^{a, b} ..	52	V-36 ^{b, c}	13	W-545.....	90	Waspaloy.....	40	Mo-0.5 Ti ^d ...	28
A-286.....	80	M-252.....	48	X-40 ^a	13	GMR-235 ^a ...	86	GMR-235 ^a ...	38	Molybdenum ^a ..	22
Inco 702 ^{a, b} ..	75	Inconel X.....	38	HS-21 ^a	12.5	Incoloy 901...	85	M-252.....	37	Nicrotung ^a ...	22
Hastelloy B...	71.5	Refractaloy 26	36	M-252.....	12	Refractaloy 26	80	D-979.....	36	Inconel 713C ^a ..	16
Discaloy ^e ...	70	X-40 ^a	33	HS-25.....	11.5	HS-25.....	70	S-816.....	29	Udimet 700...	16
HS-21 ^a	70	S-816.....	31	Inconel 700 ^b ..	9	S-816.....	65	X-40 ^a	29	GMR-235 ^a ...	13
Refractaloy 70	70	HS-25.....	30	N-155.....	8.8	A-286.....	63	S-816 ^a ...	28	Udimet 500...	12
Hastelloy C...	69	Hastelloy B ^a ..	29	Hastelloy X ^a ..	8	Refractaloy 70	56	Refractaloy 26	27	Molybdenum ^d ..	11.5
Nivco.....	66	V-36 ^{b, c}	29	HK ^a	6.5	S-816 ^a ...	56	HS-25.....	24	X-40 ^a	11.3
N-155.....	62	S-590.....	28	HH ^a	6	Discaloy.....	55	V-36.....	24	S-816 ^a ...	11
S-590.....	62	HS-21 ^a ...	27	HT ^a	5.8	Hastelloy C...	55	HS-21 ^a ...	22	HS-21 ^a ...	9.4
X-40 ^a	61	Hastelloy B...	26	Inco 702 ^{a, b} ..	4.2	Inconel 702...	55	S-590.....	22	V-36.....	9
Hastelloy X...	58	Hastelloy C...	26			Nivco.....	54	Incoloy 901...	20	Waspaloy.....	8
16-25-6.....	55	N-155.....	26			HS-21 ^a ...	52	N-155.....	20	HS-25.....	7.5
N-155 ^a ...	52	Hastelloy C ^a ..	25			Hastelloy B ^a ..	51	N-155 ^a ...	19	Inconel 700...	5.6
19-9DL.....	50	N-155 ^a ...	25			Hastelloy B...	50	Refractaloy 70	19	N-155.....	5
HH ^a	46	16-25-6.....	24			N-155.....	50	Hastelloy C ^a ..	18.5	HT, HK ^a ...	4.5
HT ^a	41	Inco 702 ^{a, b} ..	23			S-590.....	50	Hastelloy B ^a ..	18	Inconel 702...	3.1
HF ^a	37	A-286.....	22			Hastelloy C ^a ..	49.5	Hastelloy C...	18		
HK ^a	35	Hastelloy X...	22			N-155 ^a ...	49	Hastelloy B...	17		
Hastelloy X ^a ..	34	Hastelloy X ^a ..	20			Hastelloy X...	44	Inconel 702...	16		
		19-9DL.....	20			X-40 ^a	44	Hastelloy X...	15.5		
		HT ^a	16.5			16-25-6.....	44	Discaloy.....	15		
		HH, HK ^a ...	16			19-9DL.....	44	A-286.....	14		
		HF ^a	13			HH ^a	35	16-25-6.....	13.5		
						Hastelloy X ^a ..	32	19-9DL.....	13		
						HT ^a	32	HT ^a	12		
						Hastelloy X ^a ..	32	HH ^a	11.5		
						HF ^a	30	HK ^a	10.5		
						HK ^a	25	HF ^a	9		

* Cast. ^b Estimated. ^c Sheet. ^d Annealed or recrystallized. ^e Stress relieved.

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